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Thinning Pine Plantations in 1971 and After

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THE SITUATION TODAY

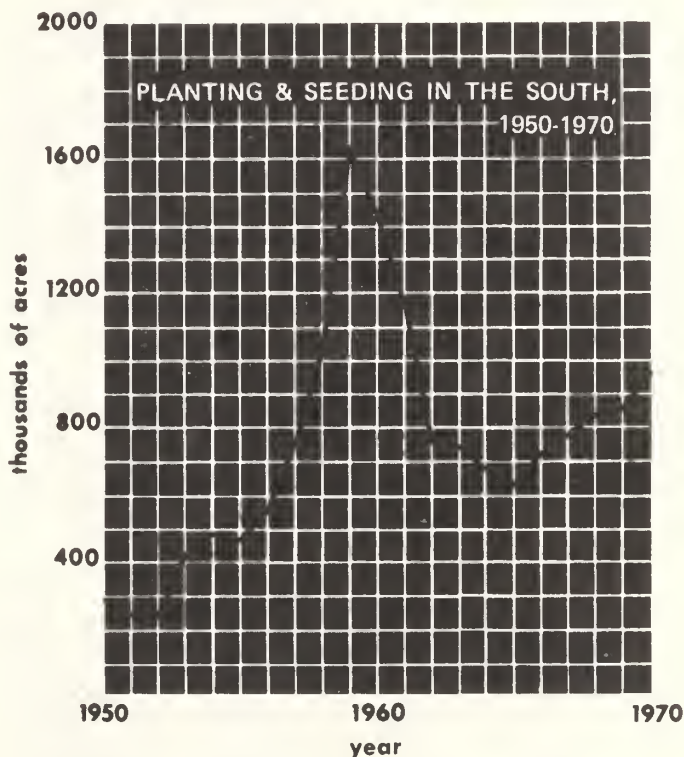
Since 1950, some 15 million acres in the Southeastern Area have been converted to pine plantations, and indications are that the planting tempo will increase. The "Third Forest" report points to the need for the planting of 30 million acres to pine by 1985, tripling the acreage now in pine plantations.

Counting back and looking forward, we can expect more than one million acres of pine plantations each year to reach the "age of decision" — that point where growth has forced the landowner to decide how to manage them.

Foresters are confronted with many variables — age, species, degree of stocking, incidence of diseased and low-vigor trees, market conditions and individual landowner's objectives, among others. But today and tomorrow, new factors have to be considered. For example:

1. **Fire protection.** Unending seas of pine offer unprecedented fire risks. Needle pileup, no fire-breaks, and no roads can add up to disaster.
2. **Shortage of professional help.** Meeting the marking demand in many areas, even with the help of trained technicians, is increasingly difficult. In addition to the problem of new plantations, management needs continue on natural stands and previously thinned plantations.
3. **Economics of harvesting.** Changing harvesting methods, dictated by economic factors and labor shortages in the woods, thrust a new and key variable into the decision-making process. The trend definitely is toward more mechanization, incorporating faster processes in harvesting wood products and dispatching them to sites of primary manufacture.

So the question of the hour is: how can pine plantations be managed today and tomorrow to serve the best interest of the landowner and the general public?



THE FIRST DECISION: CLEARCUT, LET IT BE, OR THIN?

Clearcut?

Clearcutting of stands approaching pulpwood size is seldom prudent except in cases of severe disease infection or fire damage. A stand infected with cronartium that has insufficient disease-free trees to provide adequate stocking should be clearcut before mortality becomes excessive.

Cronartium infection is considered severe if it has killed more than half the trunk circumference of 50 percent of the trees in the stand. If less than 250 trees, well distributed, remain in sound condition after a fire, the stand can be considered severely damaged.

These guidelines on plantation management for the practicing forester have been compiled by an interdisciplinary task force of the Southeastern Area, State and Private Forestry of the U. S. Forest Service. The task force made extensive use of forestry research findings, in addition to conducting a field study through cooperation of the Louisiana Forestry Commission. For further information write to: Director, State and Private Forestry, 1720 Peachtree Road, N.W., Atlanta, Georgia 30309.

When a tree approaches pulpwood size, its form class will rapidly improve from perhaps 60 to 80 percent during the next 10 to 15 years. Each percent increase in form class means a 2 percent increase in cubic volume. Tree height is also rapidly increasing as follows for loblolly pine:

| Site index 50-year basis | Height at age | | |
|-----------------------------|------------------|----|----|
| | 10 | 15 | 20 |
| | ----- Feet ----- | | |
| 70 | 24 | 34 | 41 |
| 80 | 28 | 37 | 47 |
| 90 | 32 | 42 | 53 |

Take, for example, a 5-inch tree at age 10 on site 80 with a form class of 60. If in the next 10 years this tree grows 3 inches in diameter and improves 15 points in form class, its merchantable height will have doubled. At the same time, its volume will increase from 0.8 cu. ft. to 5.0 cu. ft. This is an increase per tree of 525 percent, an increase of such magnitude that it should discourage early plantation liquidation.

The rapid increase in volume in a slash pine plantation is illustrated by the yields shown in Table 1.

Table 1. Yields From Unthinned Slash Pine Plantations (600 trees per acre)

| Site Index (25-yr. basis) | Volume in Cords at age | |
|------------------------------|------------------------|------|
| | 15 | 20 |
| 50 | 7.6 | 15.7 |
| 60 | 15.5 | 28.4 |
| 70 | 25.9 | 44.3 |
| 80 | 28.9 | 63.8 |

Source: SE 35, Multiple Products Yield Estimates for Unthinned Slash Pine Plantations — Pulpwood, Sawtimber, Gum, by Bennett and Clutter, 1968.

Another consideration: By the time the stand reaches pulpwood size, it has passed its period of highest fire risk. From that point on, the opportunity for salvage becomes greater.

Let It Be?

With clearcutting out of the question in nearly all cases, then, the next question is whether to leave the stand alone. In a few cases, it may be advisable to do just that:

1. If the owner is growing strictly for pulpwood, he will realize a greater yield in cubic feet in rotations up to 30 years by not thinning his stand at all. Harvest should be delayed until competition threatens to cause stagnation or heavy mortality of

merchantable size trees. This is not necessarily the best economic choice, however, since all returns are deferred until time of harvest.

2. In areas of high insect and disease incidence, thinning could endanger the healthy stand. Trees heavily infested with cronartium can be allowed to grow for up to eight more years without interference if less than 50 percent of the trunk circumference is killed (cankered). If *Fomes annosus* is extremely virulent in the immediate area, thinning should probably be avoided and plantations carried unthinned to age 25-30 and then clearcut.

Keep in mind, however, that unthinned stands contribute little to range and wildlife needs.

Thin?

For the great majority of pine plantations with stocking of 700 or more trees per acre, the answer is to thin about the time that the stand reaches pulpwood size. There are many advantages, including:

1. Increase in rate of return on planting investment by developing large trees that bring high stumpage prices;
2. Early returns to liquidate establishment costs promptly,



Harvest leftovers. Limbs and tops covering the ground after harvesting operation increase fire hazard. For this reason, it is important to remove as much fuel as possible before harvesting by prescribed burning.



No access. Wildfire completely destroyed this direct-seeded plantation. The forest fuel had not been reduced by prescribed burning and fire-fighting equipment had no ready access into the area.

3. Periodic regular income;
4. Salvage of trees that will soon die;
5. Concentration of growth on the best trees;
6. Better access for fire equipment;
7. Enhancement of wildlife habitat.

THE SECOND DECISION: WHEN TO THIN?

To judge the time of first thinning, one rule of thumb is to wait until the average tree to be cut is at least 6 inches in diameter and the smallest trees to be cut into pulpwood have at least 2 sticks. These are minimal requirements. Pulpmill specifications may increase these requirements or a good post market may permit earlier utilization of the smaller stems needing removal. The time to thin slash plantations is more critical than for loblolly, however, because once slash has reached the stagnation point, response to thinning is slow or non-existent. Slash stands with 1000 or more surviving trees, for example, will probably require thinning before all trees are of merchantable size.

Another point to consider is the amount of tops to be left in the woods. Every effort should be made to cut to the smallest practicable top diameter. The difference between cutting to a 4-inch and a 2-1/2-inch top, for example, might mean leaving up to 10 percent additional wood fiber on the ground. Not only is this a waste of money and wood resources, but it adds to the forest fuel, creating an added fire hazard.

From the standpoint of insect and disease spread, time of year to thin is also important. In areas where ips, black turpentine beetles or southern pine beetles are a problem, cutting in plantations should

be made during the fall or winter months when brood buildups will not occur in the fresh stumps and logging slash.

Most information on *Fomes annosus* indicates the least danger of infection spreading is during the months when mean high temperatures exceed 70° F. Treatment of stumps with Borax immediately after cutting is effective.

THE THIRD DECISION: HOW TO THIN?

Individual tree selection gives the forester the maximum opportunity to select and favor potential crop trees. In the case of a small landowner who does his own marking and his own harvesting, selective thinning has no peer. In the majority of cases, however, this method may not be possible for several reasons:

1. Cost of marking may be prohibitive;
2. Difficulty of cutting and felling, because of dense branches, could reduce stumpage prices;
3. The system does not provide access lanes for future harvesting and fire fighting; and
4. Since the method doesn't lend itself to mechanical harvesting, contractors may refuse to harvest selectively marked stands. Lack of labor and low production rates per man-day make manual thinning less feasible each year.

Row Thinning

Row thinning is economical because it makes mechanical harvesting possible. Daily pulpwood production per man is increased and labor, marking, and administrative costs are reduced substantially. In heavily stocked plantations an economic analysis of short rotations shows very little difference in



More mechanization. The trend in harvesting is toward more mechanization with light, go-anywhere equipment. Row thinning will create access lanes through the plantation.



Double-row firebreaks. Removing a double row serves to break up a large, contiguous plantation, creating a firebreak to separate tree crowns and to provide access for fire-fighting equipment. In addition, wildlife food can be grown in the opening.

rates of return between row thinning (except alternate row) and selective thinning when costs of marking are considered. The same is true for longer rotations when first thinnings are followed by periodic selectively marked thinnings. True, row thinning may lower final stand quality to some extent, but it does not restrict the development of crop trees materially when more than 300 trees are left for final crop tree selection. One point: in all systems of row thinning some crossrows should be taken, also, to facilitate fire fighting. Following are general guidelines for various combinations.

Alternate rows — Not recommended except for stands with 1000 or more trees to the acre that require drastic treatment to maintain growth. But if stand is badly infected with cronartium, this system should be discarded because too few healthy trees would be left after the second thinning.

Every third row — For plantations with 700 to 1000 trees per acre when cronartium is not a major problem (less than 20 percent of stand infected). Limited selective thinning can be done in residual rows to upgrade the stand.

Every fourth row — This system offers many advantages: (1) selective thinning of the two outside rows remaining can be quite flexible; (2) cronartium-killed trees can be removed without diminishing the stand; and (3) row thinning can be utilized on the middle row the next time around if necessary.

Every fifth row or more — This offers about the same advantages described above. Remember, though, that future row thinnings will be more practical if the even-numbered rows are removed.

Where ice and glaze damage is a problem, more fre-

quent light thinnings should be made to maintain sturdy trees with vigorous, compact crowns.

As a broad rule of thumb, on better sites use the system that will cut to 85 square feet basal area when frequent thinnings are possible, unless naval stores or sawtimber is a desired product. Leave 75 square feet basal area when frequent thinnings are not possible. Cutting to much below 75 feet will reduce total volume materially even though increasing diameter growth. Therefore, it should be avoided unless managing for sawtimber on short rotations.

In some stands, because of the terrain or the tendency of the tree planters to meander, it is virtually impossible to identify and remove a row. In such stands, "road" thinning must be practiced with the timber marker spotting or flagging out the aisle of trees that he wishes removed. This will be more expensive but it is frequently needed where the terrain and soil characteristics are such that improperly located roads might start erosion.

Thinning of Residual Rows

For the most part, the same general rules apply for thinning the residual rows as in the selective marking of a full stand of timber. In other words, concentrate on putting diameter growth on selected crop trees. If additional row thinnings are planned, however, the timber marker must keep in mind the number of trees that will remain after the *next* row thinning. Also, as mentioned before, cronartium-infected trees can be allowed to grow until the next thinning if less than 50 percent of the trunk circumference is killed.

Prescribed Burning

Fire risk is already high in large, contiguous plantations. Any harvesting operation, with the attendant logging slash, increases this risk. By all means, plantations should receive a prescribed burn under direction of a forester immediately before each thinning. This should present no problem, because the slash will deteriorate in less than five years.

Wildlife Considerations

Thinning enhances wildlife habitat. However, modifications of prescriptions will vary with the degree of a landowner's willingness to sacrifice wood production for game benefits.

As the crowns of young pines expand, they shade out the understory and cover the ground with needle litter, causing game food production to decline rapidly. Perennial grasses and forbs may become sparse or vanish completely. Of all the environmental factors influencing composition, growth and vigor of plants, light is the one most

easily modified and controlled by stand manipulation. Opening the canopy early in the life of the plantation through row thinning would help provide this light benefiting all species of wildlife.

To benefit game most, thinnings should begin at an early age and follow at intervals of five to seven years. Individual tree selection in early thinning permits some additional light to stimulate understory vegetative growth and fruits. Harvesting pine trees by individual rows creates larger openings in the canopy, stimulating even more growth of understory plants and increasing nutrition values.

Removing two rows of pine at intervals provides additional benefits for wildlife by providing larger breaks in the canopy that persist for a longer period of time. Openings created by double row thinning can be even more effective for wildlife when planted to preferred game foods.

FUTURE PLANTATIONS

Wide Spacing

The forest manager can no longer plant trees without thought as to how the trees will be harvested or the risk of forest fires. At thinning time, he may have to compromise between what is best from a silvicultural standpoint and the economics of a mechanized harvesting system.

With few exceptions, present plantations are too tightly spaced. Where 900 to 1200 trees per acre were planted in the past, from 400 to 700 should be planted in the future depending on species, anticipated survival rate and landowner's objectives.

How will this wider spacing affect growth and yield? At Auburn, Alabama, at age 14 unthinned 6'x 6' plantations had produced 2,220 cubic feet of rough wood and average tree d.b.h. was 5.0 inches. Comparative figures for unthinned 8'x 8' plantations were 1,884 cubic feet and 6.1 inches.

Yields from closely spaced plantations are not proportionately greater than for wider spacings. Costs of planting the additional trees, and the longer period required to reach merchantable size are also to be considered. On site quality 60 for slash pine, yields at age 20 show 500 trees/acre producing 26.8 cords and 700 trees per acre having a yield of 29.8 cords. Five hundred trees/acre, or 71% as many trees, produced 90% as much volume as the 700 trees/acre and the average d.b.h. at the wider spacing was .6 inch larger. The wider spacing will shorten the sawtimber or plywood bolt rotation while producing almost as much merchantable cubic volume in the long run.

Where spacing of 8' between rows is used, the first thinning can remove every third row as in the more densely stocked plantations. Plantations with rows 10' or more apart, can be selectively thinned since a truck or mechanical harvester can move between the rows.

Wider spacings make the time of first thinning less critical. Diameter growth will continue at a rapid rate for a longer period of time, permitting one to delay thinning. Faster diameter growth will permit early thinning if limby boles are not considered a drawback.

Fire Protection

Fire protection should be a major consideration in planning new plantations. The design should include:

1. Proper spacing that allows for good stand density but wide enough to allow both fire fighting and harvesting equipment to move freely within the stand;
2. Block layout to include distribution of age classes so that the older stands can be fireproofed and used to separate younger stands;
3. Construction of fire lanes two or more rows wide in two directions to border the age class blocks (these lanes will offer additional wildlife and range benefits);
4. A pre-planned program of prescribed burning to reduce fuel hazard.



Third-row thinning. In this plantation, thinning operations removed every third row. Sufficient trees remain on both sides of the row for selection of final crop trees. Too, harvesting equipment has easy access for future thinning.

GUIDELINES FOR MANAGEMENT OF PULPWOOD-SIZE STANDS*

| SITUATION | Clearcut | Let It Be | Selection Thinning | Alternate Row | Third Row | Fourth Row | Fifth Row or More |
|---|----------|-----------|--------------------|---------------|-----------|------------|-------------------|
| Stand has severe disease infection | X | | | | | | |
| Stand has severe fire damage | X | | | | | | |
| Owner growing strictly for pulpwood | | X | | | | | |
| Stand located in area of high insect and disease incidence | | X | | | | | |
| Owner can do own marking and harvesting | | | X | | | | |
| Marking services readily available and contractors in area willing to harvest selectively marked stands | | | X | | | | |
| Slash stands of 1000 or more trees to acre and free of disease | | | | X | | | |
| Plantations with 700-1000 trees to acre——crownartium not major problem | | | | | X | | |
| 20-50% of stand infected with crownartium | | | X | | | X | X |
| Ice and glaze damage a major hazard | | | X | | | | X |
| Wildlife a major management objective | | | | | X | | |

* Intended only as a quick checklist. In many cases, more than one alternative is open to the landowner and decisions must be made on an individual basis.

